APPENDIX J-F-36

STANDARD OPERATING PROCEDURE FOR SUB-SLAB SOIL GAS PROBES

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1.0 PRIOR PLANNING AND PREPARATION

Prior to installing a sub-slab gas probe:

1. Review the Work Plan and HASP with the Project Coordinator. Understand the existing site geologic/hydrogeologic conditions such as the type of soil, level of water table or perched groundwater table, and properties of refuse (if installing a probe in a landfill) such as depth, leachate levels or perched leachate levels. Know the seasonally high and low water table and leachate elevations, and know if perched conditions exist.
2. Assemble all required equipment, materials, log books, and forms.
3. Coordinate with a drilling/coring contractor (if one is retained) to ensure the work can be completed and to provide them with all relevant information to complete the job prior to arriving on site.
4. Obtain information on the probes to be installed to ensure a complete understanding of the task to be performed. Required information for installation includes knowing the type of gas probe construction materials that are to be used, including knowing the diameter of the probe, depth of probe (length of riser), type and amount of packing material, type of probe material, and planned location for each probe. Also determine if multilevel probes are required.
5. Determine the type of analyses that are required from the probes after installation, and the type of gas monitoring that is required during the drilling and installation of the probe.
6. Arrange access to the site, especially if the property owner is not our client. Obtain all necessary keys. Also consider site conditions (e.g., is snow removal required?).
7. Determine excess soil or refuse disposal procedures before commencing drilling/coring activities.
8. Determine drilling or property access notification requirements with the Project Coordinator. Notify the client, landowner, and appropriate regulatory agencies and complete utility clearance activities in accordance with the FSP.
9. Understand and review the potential health and safety hazards associated with the task and with the site.

These considerations should have been incorporated during development of the Work Plan and should be discussed with the Project Coordinator.

2.0 EQUIPMENT DECONTAMINATION

Prior to use between gas probe locations, drilling and sampling equipment must be decontaminated in accordance with the Work Plan, the Quality Assurance Project Plan (QAPP), or the methods presented in the following section.

The minimal procedures for decontamination of drilling or excavating equipment are:

1. Hot water and detergent wash (brushing as necessary to remove particulate matter).
2. Potable, hot water rinse.

Cover clean equipment with clean plastic sheeting to prevent contact with foreign materials.

On environmental sites, soil sampling equipment (e.g., split-spoons, trowels, spoons, shovels, and bowls) is typically cleaned as follows:

1. Wash with clean potable water and laboratory detergent, using a brush as necessary to remove particulates.
2. Rinse with potable water.
3. Rinse with deionized water.
4. Air dry for as long as possible.

3.0 INSTALLATION PROCEDURES – SUB-SLAB GAS PROBES

Sub-slab soil gas probes allow for collection of sub-slab soil gas samples from directly beneath the slab of a building. Note that sub-slab soil gas probes are not recommended when groundwater is present directly below the slab, as drilling through the slab could allow groundwater to enter the building. Sub-slab soil gas probes can be installed using different methods: (1) utilizing a small diameter hole, (2) a Vapor Pin™. Summaries of the steps involved in the installation of sub-slab soil gas probes is presented below:

Small Diameter Sub-Slab Soil Gas Probe

1. Prior to drilling holes into the building floor, the location of utilities coming into the building (e.g., gas, electrical, water, and sewer lines, etc.) will be identified. Avoid installing sub-slab soil gas probes near where utilities penetrate the slab as these may be entry points for downward ambient air migration through the slab during sub-slab soil gas sampling.
2. A rotary hammer drill or equivalent equipment will be used to drill a "shallow" [approximately 1-inch (2.5 cm) deep] outer hole [approximately 7/8 inches (2.2 cm) in diameter] that partially penetrates the floor slab. Cuttings may be removed using a towel moistened with distilled water or small portable vacuum cleaner.
3. The rotary hammer drill or equivalent equipment will be used to drill a smaller diameter inner hole, within the center of the outer hole, approximately 3/8 inch (9.5 mm) in diameter through the floor material and approximately 3 inches (7.6 cm) into the sub-slab bedding material to create an open cavity. The outer hole will be cleaned with a towel moistened with distilled water.
4. Chromatography grade 316 stainless steel or brass tubing will be cut to a length that allows the probe to float within the slab thickness to avoid obstruction of the probe with sub-slab bedding material. The tubing will be approximately 1/4-nch (6.4 mm) in diameter. Where necessary, the compression fittings will be stainless steel or brass (approximately 1/4-inch O.D. and 1/8-inch NPT) Swagelok® female thread connectors. Whenever possible, the probes will be constructed prior to drilling to minimize exposure time, or venting, of the sub-slab bedding material through the open hole.
5. The sub-slab soil gas probe will be placed in the holes so that the top of the probe is flush with the top of the floor. The top of the probe will have a recessed stainless steel or brass plug. A quick-drying, Portland cement slurry will be injected or pushed into the annular space between the probe and the outer hole. The cement will be allowed to dry for at least 24 hours prior to sampling.

<u>Vapor Pin</u>^{TM}Borings should be completed with the use of a rotary hammer drill. The specific drill utilized must be capable of utilizing the drill and coring bits identified in the steps below as well as sufficient size to penetrate the expected thickness of the concrete present.

General List of Materials

Installation of Vapor Pins™ utilizes products available from Cox-Colvin & Associates, Inc. Equipment needed for installation includes:

1. Silicone sleeve
2. Hammer drill
3. 5/8-inch diameter hammer bit (Hilti™ TEYX 5/8" x 22" #00206514, or equivalent)
4. 1½ inch diameter hammer bit (Hilti™ TEYX 1½" x 23" #00293032, or equivalent) for flush mount applications
5. 3/4 inch diameter bottle brush
6. Wet/dry vacuum with HEPA filter (optional)
7. Vapor Pin™ installation/extraction tool
8. Dead blow hammer
9. Vapor Pin™ flush mount cover, as necessary
10. Vapor Pin™ protective cap
11. Equipment needed for abandonment:
12. Vapor Pin™ installation/extraction tool
13. Dead blow hammer
14. Volatile organic compound-free hole patching material (hydraulic cement) and putty knife or trowel

1. *Flushmount Vapor Pin™ Installation Protocol*Prior to drilling holes in a foundation or slab, contact local utility companies to identify and mark utilities coming into the building from the outside (e.g., gas, water, sewer, refrigerant, and electrical lines). Consult with a local electrician and plumber to identify the location of utilities inside the building.
2. Set up wet/dry vacuum to collect drill cuttings.
3. Drill a 1 1/2- inch diameter hole at least 1 ¾ inches into the slab.
4. Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.

5. Drill a 5/8 inch diameter hole through the slab and at least six inches into the underlying soil to form a void.
6. Remove the drill bit, brush the hole with the bottle brush, and remove the loose cuttings with the vacuum.
7. Assemble the Vapor Pin™ assembly by threading the Vapor Pin™ into the extraction/installation tool and placing the silicone sleeve over the barbed end.
8. Place the lower end of the Vapor Pin™ assembly into the drilled hole. Place the small hole located in the handle of the extraction/installation tool over the Vapor Pin™ to protect the barb fitting and cap, and tap the Vapor Pin™ into place using a dead blow hammer. Make sure the extraction/installation tool is aligned parallel to the Vapor Pin™ to avoid damaging the barb fitting.
9. Unscrew the threaded coupling from the installation/extraction handle and use the hole in the end of the tool to assist with the installation. During installation, the silicone sleeve will form a slight bulge between the slab and the Vapor Pin™ shoulder.
10. Place the protective cap on the Vapor Pin™.
11. Cover the Vapor Pin™ with a flush mount cover.
12. Allow 20 minutes or more for the sub-slab soil gas conditions to equilibrate prior to sampling.
13. Remove protective cap and connect sample tubing to the barb fitting of the Vapor Pin™.

3.1 INSTALLATION DOCUMENTATION

Details of each sub-slab soil gas probe installation should be recorded on CRA's standard Stratigraphic Log Overburden, or recorded within a standard CRA field book. The Well Instrumentation Log is provided for recording the overburden well instrumentation details, and can be used for sub-slab soil vapor probe installations. This figure must note:

- borehole depth
- slab thickness
- probe perforation intervals
- plug intervals
- surface cap detail

- sub-slab soil gas probe material
- sub-slab soil gas probe instrumentation (i.e., probe length)
- sub-slab soil gas probe diameter
- cement slurry seal detail
- stickup/flush-mount detail
- date installed

Each sub-slab soil gas probe installed must have accurate field ties to the center of the sub-slab soil gas probe from three adjacent permanent features of the structure within which the probe is installed, each located in a different direction from the installation.

Each sub-slab soil gas probe must be permanently marked to identify the sub-slab soil gas probe number designation.

4.0 RESPIRATORY PROTECTION

The HASP must be followed with regard to respiratory protection.

5.0 FOLLOW-UP ACTIVITIES

Once the sub-slab soil gas probe(s) have been completed, the following activities need to be done:

1. Conduct initial monitoring round of gas probes.
2. All logs will be submitted to CRA's hydrogeology department who will be responsible for the generation of the final well log.
3. Arrange surveyor to obtain accurate horizontal and vertical control.
4. Gas probe/boring locations will be accurately plotted on the site plan, since boring locations may change in the field due to utility interferences or other conditions.
5. Tabulate sub-slab gas probe details.
6. A summary write-up on field activities including, but not necessarily limited to such items as drilling method(s), construction material, etc.
7. Field book will be kept at the appropriate CRA office.

6.0 FIELD INSTRUMENTATION CALIBRATION

Sampling or monitoring equipment used in the sub-slab soil gas and outdoor air sampling program to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specification and requirements. Field calibration of the personal sampling pump and PID meter will be carried out prior to sampling activities.

The vacuum gauge used to measure canister vacuum will be calibrated and provided by the laboratory. The vacuum gauge will be returned to the laboratory for the laboratory to obtained vacuum measurements prior to sample analysis (checking canister integrity was maintained during shipment). Using a common vacuum gauge will avoid variations in vacuum measurements that can arise due to using different vacuum gauges.

7.0 SUB-SLAB SOIL GAS SAMPLING PROTOCOL

The following sections describe the protocol for sub-slab soil gas sampling from permanent sub-slab soil gas probes. For evaluating vapor intrusion, permanent sub-slab soil gas probes are preferable to allow for multiple sub-slab soil gas sampling events. More than one sub-slab soil gas sampling event is often required when assessing vapor intrusion to address seasonal variations and temporal variability commonly observed in sub-slab soil gas concentrations.

Sub-slab soil gas sampling should commence a minimum of 24 hours following installation of the sub-slab soil gas probes, to allow time for disturbances created by drilling to dissipate and allow the formation to return to an equilibrium condition. In fine-grained soil conditions, consideration should be given to allowing a greater amount of time for equilibrium conditions to become re-established (e.g., 72 hours). Sub-slab soil gas sampling will not be performed during or within 48 hours of a significant rainfall event [e.g., >0.5 inches after Cal EPA (2003)]. This will avoid the potential that increased moisture content in the unsaturated zone soil could temporarily dampen sub-slab soil gas concentrations, or possibly prevent sub-slab soil gas sample collection (i.e., such as in cases where the sub-slab soil gas probe screened interval could become temporarily saturated due to the passing infiltration front). In fine-grained soil conditions, consideration should be given to allowing a greater amount of time for rainfall events to dissipate. The potential influence of rainfall events on sub-slab soil gas concentrations is less of concern in cases where the sub-slab soil gas probes are located beneath impervious ground cover (e.g., pavement or building foundation).

A summary of the steps involved in sub-slab soil gas sampling is presented below:

i) Sub-slab soil gas samples for assessing the vapor intrusion pathway will be collected using certified clean Summa™ canisters. Only canisters certified clean at the 100 percent level can be used for sub-slab soil gas sampling activities (i.e., pre-cleaned at the laboratory in accordance with U.S. EPA's TO-15 method and documentation of the cleaning activities will be provided by the laboratory). Summa™ canisters typically come in 1-, 1.7-, and 6-liter capacities, depending upon laboratory availability. Consideration should be given to using smaller capacity canisters to reduce sample volume and increase confidence that the sub-slab soil gas sample is drawn from the formation immediately surrounding the probe screen during sampling. Larger volume samples can promote drawing ambient air down the annulus of the sub-slab soil gas probe which can dilute the sub-slab soil gas sample. The use of the smaller canister sizes becomes more critical in fine-grained soil conditions where the formation may not give up significant sub-slab soil gas volumes (in this case, ambient air infiltration down the sub-slab soil gas probe annulus can be more problematic).

ii) The Summa™ canisters will be fitted with a laboratory calibrated critical orifice flow regulation device sized to restrict the maximum sub-slab soil gas sample collection flow rate to approximately 100 milliliters per minute (mL/min), which corresponds to the lower end of the maximum sub-slab soil gas sampling flow rate recommended by Cal EPA (2003) of 100 to 200 mL/min. The 100 mL/min maximum flow rate translates to sample collection times of 10, 17, or 60 minutes, respectively, for of 1-, 1.7-, or 6-liter canister capacities. A maximum flow rate of 100 mL/min is recommended to limit VOC stripping from soil, prevent the short-circuiting of ambient air from ground surface down the sub-slab soil gas probe annulus that would dilute the sub-slab soil gas sample. A maximum flow rate of 100 mL/min increases confidence that the sub-slab soil gas sample is drawn from immediately surrounding the screened interval.

iii) A vacuum gauge will be supplied by the laboratory and used during sample collection to measure the initial canister vacuum, canister vacuum during sample collection, and residual canister vacuum at the end of sample collection. The vacuum gauge will be returned to the laboratory and used by the laboratory to measure the residual canister vacuum upon receipt of the canisters by the laboratory. Using the same vacuum gauge throughout the entire sampling process will eliminate discrepancies between vacuum measurements that can arise from using different gauges with a potentially different sensitivity and/or calibration.

iv) The canister will be connected to the sub-slab soil gas probe valve at the surface casing using the sampling assembly that is depicted on Figure 15.5. The sampling assembly is connected using short lengths [e.g., 1-foot (0.3 m)] 1/4-inch (6.4 mm) or 3/8-inch (9.5 mm) diameter tubing (the tubing material will be Teflon® or nylon) and air-tight stainless steel or brass tee-connectors and tee-valves (e.g., Swagelok® type). The canister will be connected to the sub-slab soil gas probe along with a vacuum gauge and a personal sampling pump, all in series, using tee-connectors or tee-valves (in the order of sub-slab soil gas probe, vacuum gauge, pump, and canister). A tee-valve will be used to connect the pump, which will allow the pump to be isolated from the sampling assembly during sample collection. Fresh tubing will be used for each sample.

v) Prior to collecting a sub-slab soil gas sample, the stagnant air in the sampling assembly tubes and sub-slab soil gas probe casing/sand pack must be removed. The sub-slab soil gas probes will be purged prior to sampling using the personal sampling pump at a flow rate of less than 200 mL/min. This ensures that the collected sub-slab soil gas sample is representative of actual sub-slab soil gas concentrations within the formation. Measurements of the lengths and inner diameters of the above-ground sampling assembly and below-ground gas probe casing, screen, and sand pack should be used to calculate the "purge volume" (the purge volume will consider the pore volume of the sand pack assuming a 30 percent sand pack porosity). Prior to sample collection, two to three purge volumes should be drawn from the probe/sample assembly, unless otherwise required by the applicable regulatory guidance. The purge data (calculated purge volume, purging rate, and duration of purging) should be recorded in the field logbook.

vi) Prior to purging, a vacuum, or tightness, test will be conducted on the sampling assembly as the first of two leak-testing steps, as described further in Section 15.2.4. Briefly, this first leak-testing step (the vacuum test) will consist of opening the valve to the personal sampling pump leaving the valves to the Summa™ canister and the sub-slab soil gas probe closed. The pump will then be operated to ensure that it draws no air from the sampling assembly (i.e., creates a negative pressure, or vacuum within the sampling assembly), thus establishing that all assembly connections are air-tight. Further details of the vacuum test are described below.

vii) Prior to purging, and following the vacuum test, the set-up for the second of the two leak-testing steps will be conducted. The second leak-testing step is the tracer compound step. A tracer compound is released at ground surface immediately around the sub-slab soil gas probe surface casing. The tracer test is used to test for ambient air leakage down the annulus of the sub-slab soil gas probe and into the sub-slab soil gas sample. The tracer compound is either monitored for in the field using a meter connected in-line to sampling assembly (e.g., helium), or is included as an analyte in the laboratory analysis of the sub-slab soil gas samples (e.g., isopropanol). The set-up requirements of the tracer compound leak-testing step are described below.

viii) Following the vacuum test, and the set-up for the tracer compound leak-testing step, the sub-slab soil gas probe purging will commence by opening the valve to the sub-slab soil gas probe and activating the personal sampling pump (and leaving closed the valve to the Summa™ canister). At the start and the end of the purging period, the total concentration of volatile organic vapors of the personnel sampling pump exhaust gas will be monitored using a portable photoionization detector (PID) meter. The PID meter will be connected in series after the personal sampling pump. Since typical PID instrument flow rates vary from approximately 300 mL/min to 500 mL/min (depending on the manufacturer and model), drawing a sample into the PID meter through the personal sampling pump likely will increase the purging flow rate temporarily until a reading from the PID meter is obtained. PID readings will be recorded and entered in the field logbook and chain-of-custody form. The PID readings will provide the laboratory with an indication of whether a sample could require dilution before analysis.

ix) Following purging, the valve to the personal sampling pump will be closed, and the valves to the sub-slab soil gas probe and Summa™ canister will be opened to draw the sub-slab soil gas sample into the canister concurrent with continuing to apply the leak-testing tracer compound. The vacuum gauge reading will be recorded during sample collection. Should the vacuum gauge reading remain elevated above 10-inches mercury (Hg) for more than 30 minutes, this will be taken to indicate that the initial vacuum in the canister has not sufficiently dissipated, and that the soil screened by the sub-slab soil gas probe does not produce sufficient sub-slab soil gas to permit sample collection.

x) To ensure some residual vacuum in each canister following sample collection, the canister vacuum will be recorded at approximately 80 percent through the expected sample collection duration. With a 100 mL/min maximum flow rate, the expected sample collection duration would be 10, 17, or 60 minutes, respectively, for canister capacities of 1, 1.7, or 6 liters. A maximum residual vacuum of 10-inches Hg is allowed. A canister residual vacuum above this value will require continued sampling until vacuum reading is below this threshold, unless the vacuum remains above 10-inches Hg for more than 30 minutes, as described above. A minimum 1-inch Hg residual vacuum will be required for the sample to be considered valid, or the sampling will be repeated using a fresh Summa™ canister. Once the vacuum is measured, the safety cap will be securely tightened on the inlet of the Summa™ canister prior to shipment to the laboratory under chain of custody procedures.

xi) The vacuum gauge provided by laboratory will be returned with the canister samples to check residual vacuum in the laboratory prior to sample analysis and recorded on the analytical data report. This check will ensure sample integrity prior to laboratory analysis, and that the canister has not become compromised during shipment to the laboratory.

xii) If the critical orifice flow regulation devices (provided by the laboratory) and sampling assembly fittings/valves are to be re-used during sampling, they will be cleaned in accordance with laboratory requirements by purging with zero air (provided by laboratory) for minimum 45 seconds at minimum 75 psi.

xiii) The canisters will be labeled noting the unique sample designation number, date, time, and sampler's initials. A bound field logbook will be maintained to record all sub-slab soil gas sampling data.

xiv) The canisters will be listed on the chain-of-custody in order of suspected highest to lowest impact, as evidenced by the recorded PID readings. Indicate on the chain-of-custody for the laboratory to analyze the canisters in order from the lowest to highest PID reading.

The sub-slab soil gas samples will be analyzed for VOCs by the project laboratory using U.S. EPA's TO-15 gas chromatograph/mass spectrometer (GC/MS) methodology, with the mass spectrometer (MS) run in full scan mode. Quality control/quality assurance (QA/QC) measures implemented during the sub-slab soil gas sampling event will include the two-step leak testing procedure (see Section 15.2.4), maintaining a minimum residual vacuum in the Summa™ canisters following sample collection, collection of one duplicate per sampling event or from at least 10 percent of the samples obtained, and collection of an ambient air sample.

8.0 SUB-SLAB SOIL GAS PROBE LEAK TESTING

The use of leak testing is recommended as a quality control check to ensure ambient air has not leaked into the sub-slab soil gas probe or sampling assembly, which may affect (i.e., dilute) the analytical results. Contaminants in ambient air can also enter the sampling system and be detected in a sample from a non-contaminated sampling probe resulting in a "false positive" result. The leak testing will be conducted in the following two steps:

- Step 1 - Vacuum Test: used to ensure that the tubing and fittings/valves that make up the sampling assembly are air tight
- Step 2 - Tracer Test: used to ensure that ambient air during sub-slab soil gas sample collection is not drawn down the sub-slab soil gas probe annulus through an incomplete seal between the formation and the sub-slab soil gas probe casing

The vacuum test and tracer test are detailed below.

Step 1 - Vacuum Test

- The sampling assembly will be connected to the sub-slab soil gas probe valve at the surface casing. Once connected, the sampling assembly will consist of the sub-slab soil gas probe, the vacuum gauge supplied by the laboratory, personal sampling pump, and Summa™ canister, all connected in series (i.e., in the order of sub-slab soil gas probe, vacuum gauge, pump, and canister), using tee-connectors or tee-valves.
- The personal sampling pump will be used to conduct the vacuum test. The vacuum test will consist of opening the valve to the personal sampling pump while leaving closed the valves to the Summa™ canister and the sub-slab soil gas probe. The pump will then be operated to ensure that it draws no air from the sampling assembly (i.e., creates a negative pressure, or vacuum within the sampling assembly), thus establishing that all assembly connections are air-tight. The sampling pump low-flow detect switch will likely activate within 10 to 15 seconds, turning the pump off. A negative pressure, or vacuum, should be established within the sampling assembly, and should be sustained for at least 1 minute.
- If the pump is capable of drawing flow, or if the vacuum is not sustained for at least 1 minute, all fittings and tubing will be checked for tightness (or replaced) and the vacuum test will be repeated.

- The reading from the vacuum gauge pressure will be recorded in field logbook to demonstrate that the pump is able to create a vacuum within the sampling assembly (it will also be noted whether the low-flow detect switch on the pump was activated), and that the vacuum is sustained for at least 1 minute.

Step 2 - Tracer Test

A tracer compound is released at ground surface immediately around the sub-slab soil gas probe surface casing and is used to test for ambient air leakage down the annulus of the sub-slab soil gas probe and into the sub-slab soil gas sample. Two options are described below for the tracer test where either isopropanol (Option A) or helium (Option B) is used as the tracer compound.

Option A - Isopropanol

- For Option A, isopropanol is used as the tracer compound. It is included as an analyte in U.S. EPA's TO-15 method, it is readily available (i.e., as isopropyl rubbing alcohol), and it is safe to use.
- Approximately 1 teaspoon (approximately 4 mL) of isopropanol (rubbing alcohol) will be mixed in 1 gallon of de-ionized water to create an approximate 1/1,000 solution.
- Paper towels soaked in the dilute solution of isopropanol will be wrapped around the sub-slab soil gas probe surface casing and ground surface immediately surrounding the surface casing. Sub-slab soil gas probe surface casing then will be covered over using clear plastic sheeting that will be sealed to the ground surface. As the ground surface finish permits, sealing the plastic sheeting to ground surface will be accomplished using tape or by weighting the edges of the plastic sheeting with dry bentonite.
- Immediately before conducting the sub-slab soil gas probe purging, remove the paper towels from the solution wringing out the towels so they are very damp, but not dripping, before placed them around the vapor probe and sealing them in place using the plastic sheeting.
- The isopropanol solution will be kept fresh, with new solution being made every hour. The solution will be mixed at a central location away from the sampling activities. The isopropanol will be kept tightly capped and kept away from all sampling equipment. The solution will be kept away from the sampling assembly until immediately before sample collection begins. Sampling personnel will wear latex gloves while handling the solution and soaked paper towels, and will remove the gloves while working with the sampling assembly.

- Soil samples with laboratory analytical results for isopropanol that are greater than 10 percent of the starting concentration of isopropanol in the vapors emitted from dilute isopropanol solution will not be considered reliable and representative of sub-slab soil gas concentrations within the formation (ITRC, 2007). The starting concentration will be calculated based on the concentration of isopropanol in the dilute solution, the vapor pressure of isopropanol, and Henry's law.
- A disadvantage in using isopropanol as the tracer compound is that it will not be known whether a significant leak occurred until after the cost of analyzing the sample has been spent. Elevated levels of isopropanol can also interfere with laboratory analytical method detection limits.

Option B - Helium

- The presence of helium within the sampling assembly will be monitored during purging and sub-slab soil gas sample collection using a helium meter installed in-line with the sampling assembly just before the personal sampling pump.
- Helium is readily available at a variety of retail businesses, is safe to use, and does not interfere with laboratory analytical method detection limits.
- A containment unit is constructed to cover the sub-slab soil gas probe surface casing. The containment unit will consist of an over-turned plastic pail set into a ring of dry bentonite to create a seal between the ground surface and the rim of the pail. The pail can be set directly on top of the sampling assembly tubing connected to the sub-slab soil gas probe, which when pressed into the dry bentonite, should create a sufficient seal around the tubing. The pail will have two holes: one to allow for the introduction of helium; and the other to allow for air trapped inside the pail to escape while introducing the helium. The second hole will also allow insertion of the helium meter to measure the helium content within the pail.
- Prior to sub-slab soil gas probe purging, helium will be introduced into the containment unit to obtain a minimum 50 percent helium content level. The helium content within the containment unit will be confirmed using the helium meter and recorded in the field logbook. Helium will continue to be introduced to the containment unit during sub-slab soil gas probe purging and sampling, but care will be taken not to increased the pressure within the containment unit beyond that of atmospheric pressure.
- During sub-slab soil gas probe purging and sampling, the helium meter will be connected in-line with the sampling assembly. In the event that the helium meter measures a helium content with the sampling assembly of greater than 10 percent of the source concentration (i.e., 10 percent of the helium content measured within the

containment unit), the sub-slab soil gas probe will be judged to permit significant leakage such that the collected sub-slab soil gas sample will not be considered reliable and representative of sub-slab soil gas concentrations within the formation (ITRC, 2007).

- An advantage of using helium as the tracer compound is that a significant leak can be detected in the field and the cost of analyzing the Summa™ canister can be avoided.

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